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Continental molluscs collected during the second Georgian-German BioBlitz 2019 in Stepantsminda, Georgia

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Abstract: The results of surveys of land and freshwater molluscs collected during a BioBlitz event held in Georgia in 2019 are reported. In total, 54 mollusc species belonging to 27 families were recorded at 44 sampling sites in Georgia. During the BioBlitz core event held from 4-7 July 2019 in the Kazbegi Municipality (Mtskheta-Mtianeti) in the Greater Caucasus in northern Georgia, 25 terrestrial gastropods and five freshwater species (three gastropods and two bivalves) were found. With regard to the terrestrial malacofauna, this amounts to 47.2 % of the known land snails and slugs known from the core area, including two species not previously recorded from the region.

Keywords: Bivalvia, freshwater snails, Gastropoda, land snails

Zusammenfassung: Die Ergebnisse von Aufsammlungen von Land- und Süßwassermolluken, die im Zuge eines BioBlitzes in Georgien im Jahr 2019 durchgeführt wurden, werden zusammengefasst dargestellt. Insgesamt wurden 54 Molluskenarten aus 27 Familien an 44 Standorten in Georgien nachgewiesen. Während der Kernaktion des BioBlitzes vom 4. bis 7. Juli 2019 in der Gemeinde Kasbegi (Mzcheta-Mtianeti) im Großen Kaukasus im nördlichen Georgien wurden 25 Landschnecken und fünf Arten aus dem Süßwasser (drei Gastropoden und zwei Muscheln) nachgewiesen. Bezüglich der terrestrischen Malakofauna entspricht dies 47,2 % der bekannten Schneckenarten aus dem Kerngebiet, inklusive zweier zuvor nicht nachgewiesener Arten.

Introduction

A ‘BioBlitz’ usually comprises a group of scientists, students, naturalists and other members of the public who create a snapshot of the variety of life that can be found in a particular area in a relatively short period of time – often less than 24 hours – and which provides an opportunity to share expertise and raising awareness of the importance of biological recording (ROBINSON & al. 2013). The concept was developed by SAM DROEGE in the USA in 1996 (ROBINSON & al. 2013), while the term was originally coined in 1996 by SUSAN RUDY of the United States National Park Service and is now widely employed, with citizen-science BioBlitzes held in many countries worldwide (e. g. LAFOREST & al. 2013).

The first Georgian-German BioBlitz was organized by the Ilia State University (ISU) and Zoological Museum Alexander Koenig (Bonn) and was held in July 2018 in the Kintrishi Protected Areas located in the Lesser Caucasus in south-western Georgia (*https://ggbc.eu/kintrishi/*). Approximately 40 participants – including Georgian-German scientists and students – took an active part in this event, which was focussing on an inventory of arthropods (but also fish and plants were investigated). Successful networking among scientists and students resulted in the organisation of a second round of BioBlitz, which was held in the Kazbegi Municipality (Mtskheta-Mtianeti, North-East Georgia) from 4-7 July 2019 (THORMANN & al. 2019), with the opportunity also to visit other places in Georgia.

The Kazbegi Municipality (Figs 1 and 2) has an area of 1081.7 km² and is situated in the middle part of the Greater Caucasus. The territory of the municipality covers both sides of the Greater Caucasus watershed, including the upper valley of the Terek River that drains to the north across the Georgian-Russian border into the Caspian Sea and the upper valley of the Tetri Aragvi River that joins the Shavi Aragvi near Passanauri to form the Aragvi River. The Aragvi river flows south into the Kura River, which eventually drains into the Caspian Sea in Azerbaijan. The most prominent geographic feature in the municipality is the dormant stratovolcano Mount Kazbek (5047 m) on the Georgian-Russian border, which is the third highest peak in Georgia and among the ten highest peaks in the Caucasus re-

gion. Major habitat types in the Kazbegi Municipality include alpine meadows, Caucasian tall forb communities, beech forests, swamps, subalpine forests, scree fields and glaciers (Fig. 1).

In this manuscript we present a list of land and freshwater molluscs collected within the framework of the BioBlitz 2019 in Georgia and compare its results with known distribution data of continental molluscs (especially land snails and slugs) from the Kazbegi Municipality, the core area of the BioBlitz.

Fig. 1: Landscapes and habitats in the Kazbegi Municipality, Mtskheta-Mtianeti, Georgia. **A.** View of Mount Kazbek (5047 m) from Stepantsminda. **B.** Gergeti Trinity Church. **C.** Upper Terek Valley south of Sioni. **D.** Darial Gorge (Terek River) at the base of Mount Kazbek. **E.** Terek Valley, Gveleti Small Waterfall (phot. M. T. NEIBER).

Materials and Methods

Samples were collected by handpicking and to a lesser extent by dry sieving in terrestrial habitats and by handpicking and scoop sieving in freshwater habitats. Geographic coordinates were determined with a GPS device. Samples were sorted in the laboratory and preserved in 70-96 % ethanol. Specimens were determined on the basis of shell characters and/or soft part anatomy (i.e., Agriolimacidae, some Gastrodontidae, some Hygromiidae, Limacidae, Lymnaeidae, some Oxychilidae and Succineidae). The following literature was used for determination: ZHADIN (1952), LIKHAREV (1962), RIEDEL (1966), CLAUSS (1975), SCHILEYKO (1978), LIKHAREV & WIKTOR (1980), HAUSDORF (1996), WIKTOR (2000), NEUBERT & BANK (2006), SYSOEV & SCHILEYKO (2009), GLÖER & PEŠIĆ (2010), KOKSHOORN & GITTENBERGER (2010), BARGUES & al. (2011), NEUBERT (2014), ZALLOT & al. (2015), NEIBER & HAUSDORF (2015), NEIBER & al. (2016, 2017, 2018), WALTHER & al. (2014b, 2016, 2018). Results for the BioBlitz 2019 core area (Kazbegi Municipality) were compared with the database of land snails and slugs compiled within the project “Biogeography of the land molluscs of the Caucasus region”, which is based on literature records and samples housed in the collections of major natural history museums (WALTHER & al. 2014).

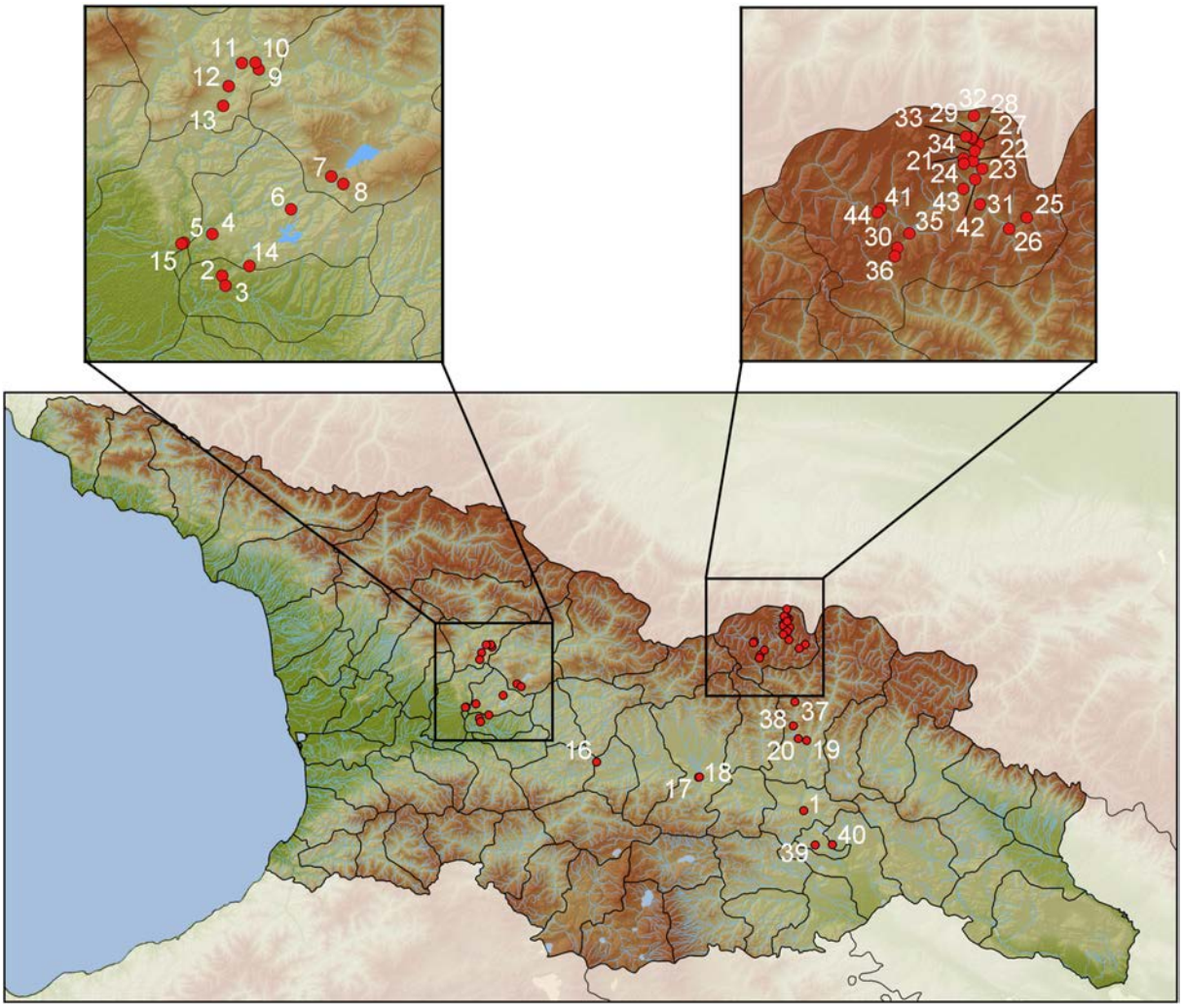

Fig. 2: Map of Georgia showing the sampling sites visited during the BioBlitz 2019. The sites in the BioBlitz 2019 core area (Kazbegi Municipality) are shown in the upper right inset.

The following sampling sites (Fig. 2) were visited during the BioBlitz 2019 (unless otherwise stated, leg. M. T. NEIBER).

1. Mtskheta-Mtianeti: Jvari Monastery, along road east of the monastery, 41°50'25"N 44°44'12"E, 600 m a. s. l., 01.07.2019.
2. Imereti: Nakhshirgele towards Kutaisi, approx. 500 m along road to Broloskedi, 42°13'48"N 42°47'27"E, 150 m a. s. l., 01.07.2019.
3. Imereti: Nakhshirgele towards Kutaisi, approx. 200 m east of bridge over Tchishura River, 42°12'54"N 42°47'54"E, 130 m a. s. l., 01.07.2019.
4. Imereti: Gelati Monastery, walls and stones along path on the southside of the monastery, 42°17'38"N 42°46'06"E, 420 m a. s. l., 01.07.2019.
5. Imereti: Kutaisi, Botanical Garden, 42°16'45"N 42°42'35"E, 160 m a. s. l., 01.07.2019.
6. Imereti: Satsire, southern outskirts of village, 42°20'06"N 42°55'48"E, 560 m a. s. l., 02.07.2019.
7. Imereti: Tkibuli towards Ambrolauri, below Nakerala Pass, 42°23'13"N 43°00'43"E, 1110 m a. s. l., 02.07.2019.
8. Imereti: Nakerala Pass, 42°22'33"N 43°02'14"E, 1230 m a. s. l., 02.07.2019.
9. Racha-Lechkhumi and Kvemo Svaneti: Rioni valley, approx. 1 km along road towards Ambrolauri, 42°32'56"N 42°51'21"E, 440 m a. s. l., 02.07.2019.
10. Racha-Lechkhumi and Kvemo Svaneti: Alpana, limestone cliffs on left side of Rioni Valley, 42°33'33"N 42°50'55"E, 420 m a. s. l., 02.07.2019.
11. Racha-Lechkhumi and Kvemo Svaneti: Alpana towards Kutaisi, Rioni Valley, limestone cliff along road, 42°33'29"N 42°49'14"E, 380 m a. s. l., 02.07.2019.
12. Racha-Lechkhumi and Kvemo Svaneti: Alpana towards Kutaisi, Rioni Valley, southern entrance of canyon-like part of valley, 42°31'19"N 42°47'39"E, 380 m a. s. l., 02.07.2019.

13. Racha-Lechkhumi and Kvemo Svaneti: Alpana towards Kutaisi, Rioni Valley, right side, north of Mekvena, 42°29'29"N 42°47'02"E, 370 m a. s. l., 02.07.2019.
14. Imereti: Navenakhevi, forest near Navenakhevi Cave, 42°14'46"N 42°50'49"E, 300 m a. s. l., 02.07.2019.
15. Imereti: Kutaisi, Bagrati Cathedral, 42°16'39"N 42°42'18"E, 210 m a. s. l., 02.07.2019.
16. Shida Kartli: Surami Pass, eastern side, 42°02'50"N 43°29'53"E, 910 m a. s. l., 03.07.2019.
17. Shida Kartli: Gori Castle, southern side of castle hill, 41°59'08"N 44°06'31"E, 620 m a. s. l., 03.07.2019.
18. Shida Kartli: Gori, Stalin Park, 41°59'12"N 44°06'49"E, 600 m a. s. l., 03.07.2019.
19. Mtskheta-Mtianeti: Ananuri towards Zhinvali Dam, approx. 4.5 km along road north of the dam, 42°09'09"N 44°45'11"E, 940 m a. s. l., 03.07.2019.
20. Mtskheta-Mtianeti: Ananuri, slope opposite monastery, beyond bridge, 42°09'38"N 44°42'10"E, 880 m a. s. l., 03.07.2019.
21. Mtskheta-Mtianeti: Chkheri Valley, right side, 42°40'14"N 44°36'35"E, 2030 m a. s. l., leg. G. BANANASHVILI, A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE, M. T. NEIBER & A. SHUBASHISHVILI, 04.07.2019.
22. Mtskheta-Mtianeti: Gergeti, north of village, 42°40'01"N 44°37'49"E, 1830 m a. s. l., leg. S. JAPARASHVILI & B. WIPFLER, 04.07.2019.
23. Mtskheta-Mtianeti: Stepantsminda, station of Ilia State University, 42°39'18"N 44°38'57"E, 1830 m a. s. l., leg. G. BANANASHVILI & A. SHUBASHISHVILI, 04.07.2019.
24. Mtskheta-Mtianeti: Gergeti Sameba, valley west of church, 42°39'46"N 44°36'38"E, 2150 m a. s. l., leg. G. BANANASHVILI, A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE, M. T. NEIBER & A. SHUBASHISHVILI, 04.07.2019.
25. Mtskheta-Mtianeti: Juta, 42°34'47"N 44°44'35"E, 2160 m a. s. l., 05.07.2019.
26. Mtskheta-Mtianeti: Jutistskali Valley, right side, near confluence with Kora River, 42°33'44"N 44°42'22"E, 1860 m a. s. l., leg. G. BANANASHVILI, A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE, M. T. NEIBER & A. SHUBASHISHVILI, 05.07.2019.
27. Mtskheta-Mtianeti: Terek Valley, Darial Gorge, east of Tsdo, 42°41'37"N 44°38'29"E, 1560 m a. s. l., 05.07.2019.
28. Mtskheta-Mtianeti: Terek Valley, Darial Gorge, south of Gveleti, 42°42'05"N 44°37'42"E, 1480 m a. s. l., 05.07.2019.
29. Mtskheta-Mtianeti: Terek Valley, Darial Gorge, near Gveleti, 42°42'13"N 44°37'37"E, 1480 m a. s. l., 05.07.2019.
30. Mtskheta-Mtianeti: Mineral Springs, Baidara Valley north of Jvari Pass, 42°31'55"N 44°28'20"E, 2250 m a. s. l., 05.07.2019.
31. Mtskheta-Mtianeti: Sno, approx. 800 m southeast of the village, 42°36'00" N 44°38'41"E, 1800 m a. s. l., leg. G. BANANASHVILI, A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE & A. SHUBASHISHVILI, 05.07.2019.
32. Mtskheta-Mtianeti: Terek Valley near confluence with Khde River, north of Dariali Monastery, 42°44'13"N 44°37'53"E, 1300 m a. s. l., leg. G. BANANASHVILI, A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE, M. T. NEIBER & A. SHUBASHISHVILI, 06.07.2019.
33. Mtskheta-Mtianeti: Terek Valley, Gveleti Small Waterfall, 42°42'18"N 44°36'53"E, 1720 m a. s. l., leg. G. BANANASHVILI, A. BIKASHVILI, B. JAPOSHVILI, P. MANKO, L. MUMLADZE, M. T. NEIBER & A. SHUBASHISHVILI, 06.07.2019.
34. Mtskheta-Mtianeti: 1 km south of the village Tsdo, 42°40'57"N 44°38'00"E, 1680 m a. s. l., leg. A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE & A. SHUBASHISHVILI, 06.07.2019.
35. Mtskheta-Mtianeti: Almasiani, southern end of village, 42°33'16"N 44°29'49"E, 1990 m a. s. l., 07.07.2019.
36. Mtskheta-Mtianeti: Jvari Pass, 42°31'08"N 44°28'01"E, 2360 m a. s. l., 07.07.2019.
37. Mtskheta-Mtianeti: Aragvi Valley, Bibiliani, southern end of village, 42°19'28"N 44°40'53"E, 1050 m a. s. l., 07.07.2019.
38. Mtskheta-Mtianeti: Aragvi Valley, between junction towards Dgnali and Tsivtskaro, 42°13'03"N 44°40'22"E, 910 m a. s. l., 07.07.2019.
39. Tbilisi: Botanical Garden, 41°41'14"N 44°48'20"E, 470 m a. s. l., 07.07.2019.
40. Tbilisi: Kakheti Highway/Aleksandre Tvalchrelidze I Turn, Hotel garden, 41°41'21" N 44°54'28"E, 480 m a. s. l., 07.07.2019.
41. Mtskheta-Mtianeti: midway between the villages Kvemo Okrokana and Ketrisi, 42°35'32"N 44°26'12"E, 2115 m a. s. l., leg. A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE & A. SHUBASHISHVILI, 07.07.2019.
42. Mtskheta-Mtianeti: 1500 m south of Stepantsminda, 42°38'19"N 44°38'04"E, 1760 m, a. s. l., leg. A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE & A. SHUBASHISHVILI, 07.07.2019.
43. Mtskheta-Mtianeti: west of village Achkhoti, 42°37'26"N 44°36'35"E, 1775 m, a. s. l., leg. A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE & A. SHUBASHISHVILI, 07.07.2019.
44. Mtskheta-Mtianeti: 260 m east of the village Ketrisi. 42°35'11"N 44°25'47"E, 2120 m a. s. l., leg. A. BIKASHVILI, B. JAPOSHVILI, L. MUMLADZE & A. SUBASHISHVILI, 07.07.2019.

Results

In total, 54 mollusc species belonging to 27 families were recorded during the BioBlitz 2019 at 44 sampling sites in Georgia. The samples comprised 51 land snails and slugs (24 families), three freshwater snails (two families) and two freshwater bivalves (one family) (Tab. 1).

During the BioBlitz 2019 core event in the Kazbegi Municipality, five freshwater species (three gastropods and two bivalves) and 25 terrestrial gastropods were recorded. In total, 53 species of land snails and slugs belonging to 24 families are currently known from the Kazbegi Municipality (Tab. 1, Figs 5-7). Of these, the Caucasus endemic *Gigantomilax daghestanus* and the widespread *Oxyloma sarsii* were recorded for the first time in this municipality, while the remaining 51 taxa were also previously found in the study area (Tab. 1, Figs 5-7). Five species, *Cecilioides acicula*, *Succinea putris*, *Serrulina serrulata*, *Oxychilus subeffusus* and *Vitrea contortula*, are only known from old records without precise locality data. Among the recorded land snail and slug species from the Kazbegi Municipality, 31 have a wider distribution (W), with many of these taxa also occurring in Central Europe (Tab. 1). Three species are endemic to Georgia (EG), eleven endemic to the Caucasus region in the sense of WALTHER & al. (2014a) including the territories of Georgia, Armenia, Azerbaijan and the Russian first order administrative units Krasnodar Kray, Stavropol Kray, Adygeya, Chechnya, Dagestan, Ingushetiya, Kabardino-Balkariya, Karachayevo-Cherkesiya and North Ossetia (EC) and eight have their distribution centre in the Caucasus region, but also occur in adjacent regions of Turkey and/or Iran (ECTI) (Tab. 1). With regard to the terrestrial malacofauna, this amounts to 47.2 % of the land snails and slugs known from the area (12 W, 2 EG, 6 EC, 5 ECTI; Tab. 1, Figs 5-7).

Tab. 1: Recorded species and sampling sites (see text). Arrangement of gastropod follows BOUCHET & al. (2017). Abbreviations – EG: endemic to Georgia; EC: endemic to the Caucasus region in the sense of WALTHER & al. (2014) including the territories of Georgia, Armenia, Azerbaijan and the Russian first order administrative units Krasnodar Kray, Stavropol Kray, Adygeya, Chechnya, Dagestan, Ingushetiya, Kabardino-Balkariya, Karachayevo-Cherkesiya and North Ossetia; ECTI: endemic to the Caucasus region and adjacent eastern Anatolia and/or the Pontic region of Turkey and/or adjacent north-western Iran; W: species/subspecies with a range extending outside the previously defined regions, usually widespread taxa. S: Sampling site(s), P: Presence in Kazbegi Municipality, R: Recorded during BioBlitz 2019 in Kazbegi Municipality, D: Distribution, w: without precise data, +: present, -: not recorded.

Taxon	S	P	R	D
Gastropoda				
Aciculidae				
Acicula moussoni BOETTGER 1879	-	+	-	EC
Megalomastomatidae				
Imerezia lederi (BOETTGER 1881)	3	-	-	EC
Pomatiidae				
Pomatias r. rivularis (EICHWALD 1829)	3, 4, 7, 8, 9, 10, 14, 15, 16, 20, 37, 38, 39	-	-	W
Lymnaeidae				
Ampullaceana balthica (LINNAEUS 1758)	31	+	+	W
Galba truncatula (MÜLLER 1774)	44	+	+	W
Planorbidae				
Planorbis planorbis (LINNAEUS 1758)	31, 43	+	+	W
Achatinidae				
Cecilioides acicula (MÜLLER 1774)	-	+ (w)	-	W
Punctidae				
Punctum pygmaeum (DRAPARNAUD 1801)	21, 44	+	+	W
Discidae				
Discus ruderatus (HARTMANN 1821)	-	+	-	W
Succineidae				
Oxyloma sarsii (ESMARK 1886)	44	+	+	W
Succinea putris (LINNAEUS 1758)	-	+ (w)	-	W
Pupillidae				
Pupilla inops (REINHARDT 1877)	-	+	-	ECTI
Chondrinidae				
Chondrina arcadica caucasica (EHRMANN 1931)	11, 12	-	-	W
Cochlicopidae				
Cochlicopa lubrica (MÜLLER 1774)	-	+	-	W

Taxon	S	P	R	D
Cochlicopa lubricella (PORRO 1838)	21	+	+	W
Enidae				
Chondrula tridens (MÜLLER 1774)	13, 17	+	-	W
Peristoma boettgeri (CLESSIN 1883)	3, 4, 12, 13, 15	-	-	EC
Pseudochondrula tuberifera (BOETTGER 1879)	44	+	+	EC
Lauriidae				
Lauria cylindracea (DA COSTA 1778)	39	-	-	W
Leiostyla caucasica (PFEIFFER 1855)	-	+	-	EG
Orculidae				
Sphyradium doliolum (BRUGUIÈRE 1792)	34, 38	+	+	W
Pilorcula t. trifilaris (MOUSSON 1856)	3, 4, 7	-	-	EC
Truncatellinidae				
Columella edentula (DRAPARNAUD 1805)	-	+	-	W
Truncatellina callicratis (SCACCHI 1833)	-	+	-	W
Truncatellina claustralis (GREDLER 1856)	44	+	+	W
Truncatellina costulata (NILSSON 1823)	-	+	-	W
Valloniidae				
Acanthinula aculeata (MÜLLER 1774)	-	+	-	W
Vallonia costata (MÜLLER 1774)	21, 44	+	+	W
Vallonia pulchella (MÜLLER 1774)	-	+	-	W
Vertiginidae				
Vertigo nitidula (MOUSSON 1876)	21	+	+	EC
Vertigo pusilla (MÜLLER 1774)	21	+	+	W
Vertigo pygmaea (DRAPARNAUD 1801)	-	+	-	W
Vertigo substriata (JEFFREYS 1833)	-	+	-	W
Clausiliidae				
Armenica unicristata BOETTGER 1877	-	+	-	EC
Elia derasa (MOUSSON 1863)	2, 4, 15	-	-	EC
Elia ossetica (MOUSSON 1863)	20, 21, 24, 32, 33, 35, 44	+	+	ECTI
Elia somchetica (PFEIFFER 1846)	21, 22, 33	+	+	ECTI
Mentissoidea rupicola (MORTILLET 1854)	19, 20, 38	-	-	ECTI
Mucronaria duboisi (CHARPENTIER 1852)	2, 4, 13, 15, 38, 39	-	-	ECTI
Mucronaria pleuroptychia (BOETTGER 1878)	4, 12, 14	-	-	EG
Pravispira semilamellata (MOUSSON 1863)	6	-	-	ECTI
Quadriplicata quadriplicata (SCHMIDT 1868)	19	-	-	EC
Scrobifera taurica (PFEIFFER 1848)	4, 5, 6, 7, 8, 12, 19	-	-	ECTI
Serrulina serrulata (PFEIFFER 1847)	-	+ (w)	-	W
Limacidae				
Eumilax brandti (MARTENS 1880) (Fig. 4B)	4, 23	+	+	ECTI
Gigantomilax daghestanus (SIMROTH 1898)	22	+	+	EC
Limacus maculatus (KALENICZENKO 1851)	-	+	-	W
Svanetia caucasica (SIMROTH 1898) (Fig. 4C)	36	+	+	EG
Agriolimacidae				
Deroceras agreste (LINNAEUS 1758) (Fig. 4E)	21, 22, 24, 26, 28, 32, 36	+	+	W
Deroceras sp. (Fig. 4D)	6	-	-	EC
Krynickillus melanocephalus (KALENICZENKO 1851)	-	+	-	W
Boettgerillidae				
Boettgerilla compressa SIMROTH 1910 (Fig. 4A)	4	-	-	EG
Vitrinidae				
Oligolimax annularis (STUDER 1820)	21	+	+	W
Vitrina pellucida (MÜLLER 1774)	-	+	-	W
Gastrodontidae				
Aegopinella pura (ALDER 1831)	-	+	-	W
Nesovitrea petronella (PFEIFFER 1853)	21, 44	+	+	W
Zonitoides nitidus (MÜLLER 1774)	-	+	-	W
Oxychilidae				
Conulopolita sieversi (BOETTGER 1879)	21, 44	+	+	ECTI
Oxychilus mingrelicus koutaisanus (MOUSSON 1863)	3, 4, 9, 10, 12, 13, 14	-	-	ECTI
Oxychilus subeffusus (BOETTGER 1879)	-	+ (w)	-	ECTI
Schistophallus duboisi (MOUSSON 1863)	4, 13	-	-	EG
Pristilomatidae				
Vitrea contortula (KRYNICK, 1837)	-	+ (w)	-	ECTI
Euconulidae				
Euconulus fulvus (MÜLLER 1774)	21	+	+	W

Taxon	S	P	R	D
Spiraxidae				
Poiretia mingrelica (BOETTGER 1881) (Fig. 4F)	3	-	-	EG
Helicidae				
Caucasotachea atrolabiata calligera (DUBOIS DE MONTPÉREUX 1840)	3, 4, 9, 10, 11, 12, 13, 14, 15	-	-	ECTI
Helix albescens ROSSMÄSSLER 1839 (Fig. 3B)	27, 32, 34	+	+	W
Helix lucorum LINNAEUS 1758 (Fig. 3A)	3, 4, 10, 12, 13, 16, 17, 18	-	-	W
Geomitridae				
Kalitinaia crenimargo (PFEIFFER 1847)	1	-	-	ECTI
Xeropicta derbentina (KRYNICKI 1836)	13, 16, 17, 18, 39, 40	+	-	W
Hygromiidae				
Caucasigena e. eichwaldi (PFEIFFER 1846) (Fig. 3C)	26, 29, 30, 32, 33, 34, 36, 41, 44	+	+	EC
Circassina frutis circassica (MOUSSON 1863)	10, 12,14	+	-	EC
Dioscuria caucasicola (LINDHOLM 1913)	-	+	-	EC
Fruticocampylaea kobensis (BOETTGER 1883)	30, 35, 44	+	+	EG
Fruticocampylaea narzanensis (KRYNICKI 1836) (Fig. 3D, E)	21, 22, 23, 24, 25, 26, 28, 29, 32, 33, 34, 41, 42, 43	+	+	EC
Harmozica ravergiensis (FÉRUSSAC 1835)	-	+	-	EC
Lasicana suanetica (BOETTGER 1883)	9, 10, 24	+	+	EC
Stenomphalia selecta (KLIKA 1894)	15, 22, 26, 39, 44	+	+	ECTI
Bivalvia				
Sphaeriidae				
Pisidium amnicum (MÜLLER 1774)	31	+	+	W
Pisidium casertanum (POLI 1791)	43, 44	+	+	W

Fig. 3: Land snails collected during the BioBlitz 2019. **A.** *Helix lucorum* (Helicidae), sampling site 4. **B.** *Helix albescens* (Helicidae), sampling site 27. **C.** *Caucasigena eichwaldi eichwaldi* (Hygromiidae), sampling site 33. **D, E.** *Fruticocampylaea narzanensis* (Hygromiidae), sampling site 33 (phot. M. T. NEIBER).

Discussion

Detailed knowledge of fine scale species distributions can contribute to a better understanding of local scale biogeographical patterns and also allows analysing the temporal distribution of species. Although the diversity of terrestrial molluscs is relatively well known for Georgia (see SYSOEV & SCHILEYKO 2009 for an overview), there is still a significant lack of high accuracy data on the distribution of most of the taxa (MUMLADZE & al. 2014). Unfortunately, only relatively few studies are available for the last 50 years focussing on the distribution of mollusc species or studies dealing with mollusc communities in Georgia (e. g., SCHILEYKO 1978, LIKHAREV & WIKTOR 1980, HAUSDORF 1996, 2000, POKRYSZKO & al. 2011, FEHÉR & al. 2014, WALTHER & al. 2014a, b, 2016, 2018, NEIBER & HAUSDORF 2015, NEIBER & al. 2016, 2018). Accordingly, any faunistic contribution on Georgian or more generally Caucasian molluscs is highly welcome and could contribute to future biodiversity studies and monitoring programs.

Fig. 4: Land snails and slugs collected during the BioBlitz 2019. **A.** *Boettgerilla compressa* (Boettgerillidae), sampling site 4. **B.** *Eumilax brandti* (Limacidae), sampling site 23. **C.** *Svanetia caucasica* (Limacidae), sampling site 36. **D.** *Deroceras* sp., (Agriolimacidae), juvenile, sampling site 6. **E.** *Deroceras agreste* (Agriolimacidae), juvenile, sampling site 24. **F.** *Poiretia mingrelica* (Spiraxidae), sampling site 3 (phot. M. T. NEIBER).

A BioBlitz event may generally be a suitable framework for quickly generating biodiversity data on a local scale and certainly raises the awareness of students and more generally the scientifically interested public about local biodiversity. Due to the short time of a BioBlitz event, a bias towards the detection of more common or conspicuous species can be expected. Rare, small or highly specialised

species that can often be reliably detected only by intensive sampling or specific sampling techniques, can be expected to escape notice.

A simple way to assess the efficacy of a BioBlitz event is to compare the recorded number of species of a given group during the event to the number of species of that group actually present in the studied area. A prerequisite for such a comparison is a reasonably complete inventory of species in the studied area. The Kazbegi Municipality has repeatedly been surveyed by naturalists and malacologists since the 19th century and has also been visited by some of the authors prior to the BioBlitz event. Compiling the findings of previous surveys resulted in a list of 51 species of land snails recorded from the Kazbegi Municipality. That this number is still an underestimation of the actual number of species present in the study area is shown by the discovery of an additional species in the area, a relatively large slug, *Gigantomilax daghestanus*, which is endemic to the Caucasus region but has not been found in northern Georgia so far. Additionally, we could verify the presence of the widespread *Oxyloma sarsii* in the region for the first time. From previous collections empty shells were known which, due to the lack of anatomical data, could only be assigned to the genus *Oxyloma* WESTERLUND 1885.

FOSTER & al. (2013) reported a discovery rate of 71-87 % of amphibians, snakes and small mammals during a BioBlitz in 2006 in Tennessee, USA. Published records for molluscs in the explicit framework of a BioBlitz could not be found in the literature, but in general a lower detection rate appears reasonable for many groups of invertebrates because of the higher overall diversity and usually smaller size. Land snails may be an exception here because under suitable conditions their shells can still be detected long after the animal has died.

It has to be emphasized that the analysis of the gastropods collected during the BioBlitz was accompanied by an intensive survey of museum collections that resulted in several species not published for Kazbegi Municipality so far (e. g. *Armenica unicristata, Aegopinella pura*). Such species records were counted as already known. Compared to the combined collection results of several malacologists over a period of 150 years (including H. LEDER, W. LINDHOLM, Z. I. KALITINA, E. CLAUSS, and several collecting trips by ourselves) a detection rate of 47.2 % is relatively high in our opinion. Our results show, however, a slight trend that small to very small species were less likely to be discovered than larger species, which can be explained by the relatively small amount of soil samples that were taken in order to allow sorting during the actual BioBlitz event.

More disconcerting is the fact that species such as *Leiostyla caucasica* or *Dioscuria caucasicola* could not be detected, although these species have their centre of distribution in the study area. Aside from not taking sufficient amounts of soil for sieving (which could explain the absence of *L. caucasica*), insufficient surveys of suitable habitats may explain why these species were not detected. Unfortunately, little is known about their specific habitat requirements. However, that does not fully explain the absence of *D. caucasicola*, the type locality of which is the Jvari Pass (sampling site 36). The species has always been rare and probably declines but the causes for this decline are far from understood.

Noteworthy is also that sampling is concentrated in the relatively easily accessible major river valleys and several valleys of tributary rivers (Figs. 5-7). Additional sampling in less accessible areas might have increased sampling efficacy, although only to some extent because considerable parts of the Kazbegi Municipality lie above 3000 m a. s. l., i. e. in an altitudinal zone which is uninhabitable for land snails in the Caucasus region.

Our sampling of freshwater molluscs recovered only five species: two bivalves – *Pisidium amnicum* and *P. casertanum* – and three gastropods – *Planorbis planorbis*, *Galba truncatula* and *Ampullaceana balthica*. Unfortunately, information on freshwater molluscs is generally scarce for waterbodies in the subalpine to alpine zone of the Greater Caucasus, a relatively low number of species was expected as the freshwater malacofauna of the eastern part of the Georgian Greater Caucasus is rather poor with regard to the number of species (ZHADIN 1952).

Among the records outside the BioBlitz core area, a record of *Boettgerilla compressa* is probably the most remarkable find. Although already known from Imereti, this rare Caucasian endemic is known from less than 20 specimens collected from a rather wide range stretching from eastern Abkhazia to Imereti.

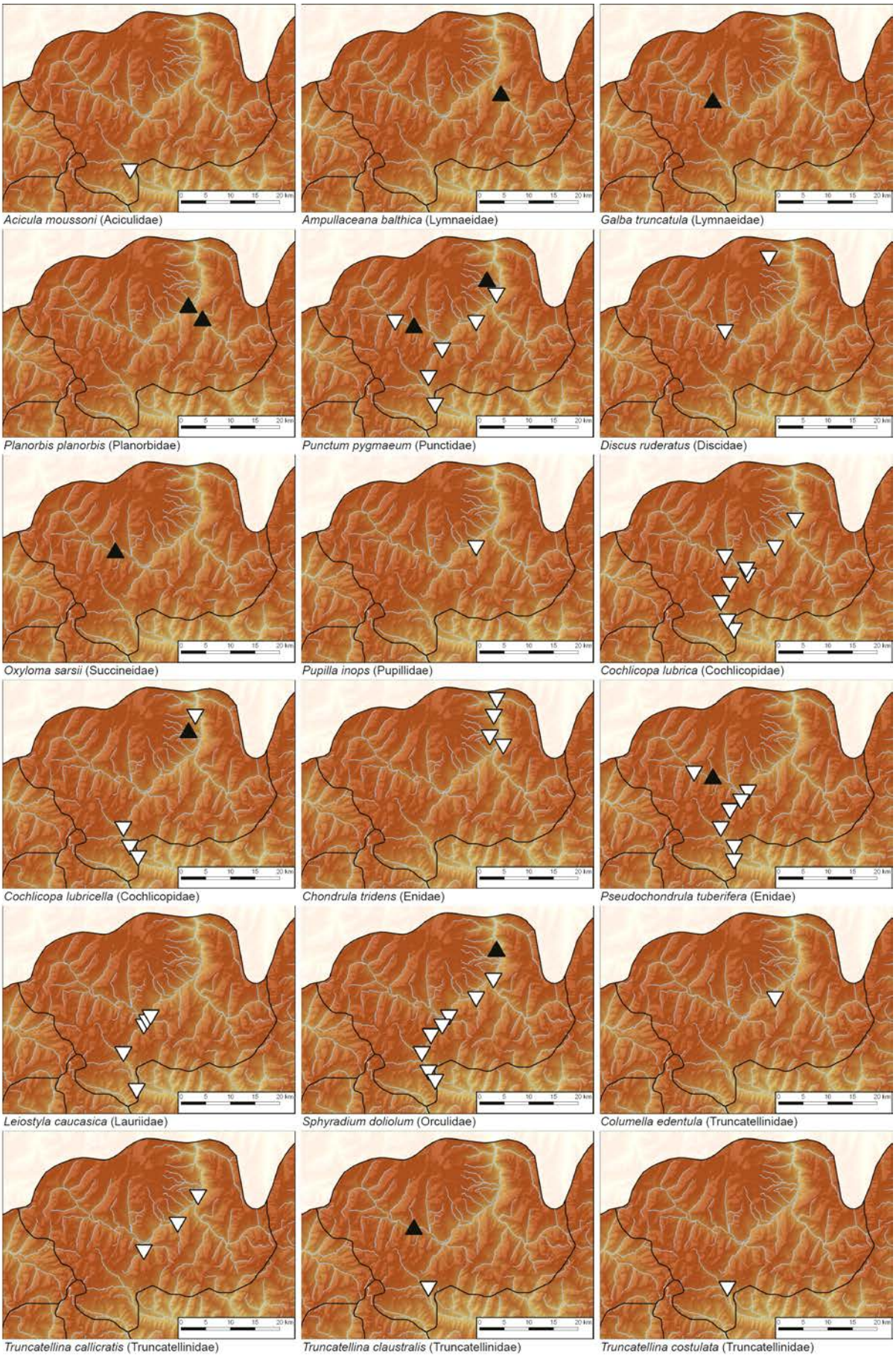

Fig. 5: Distribution of terrestrial and freshwater gastropods in the Kazbegi Municipality. Black triangles: records during the BioBlitz 2019, white triangles: previous records.

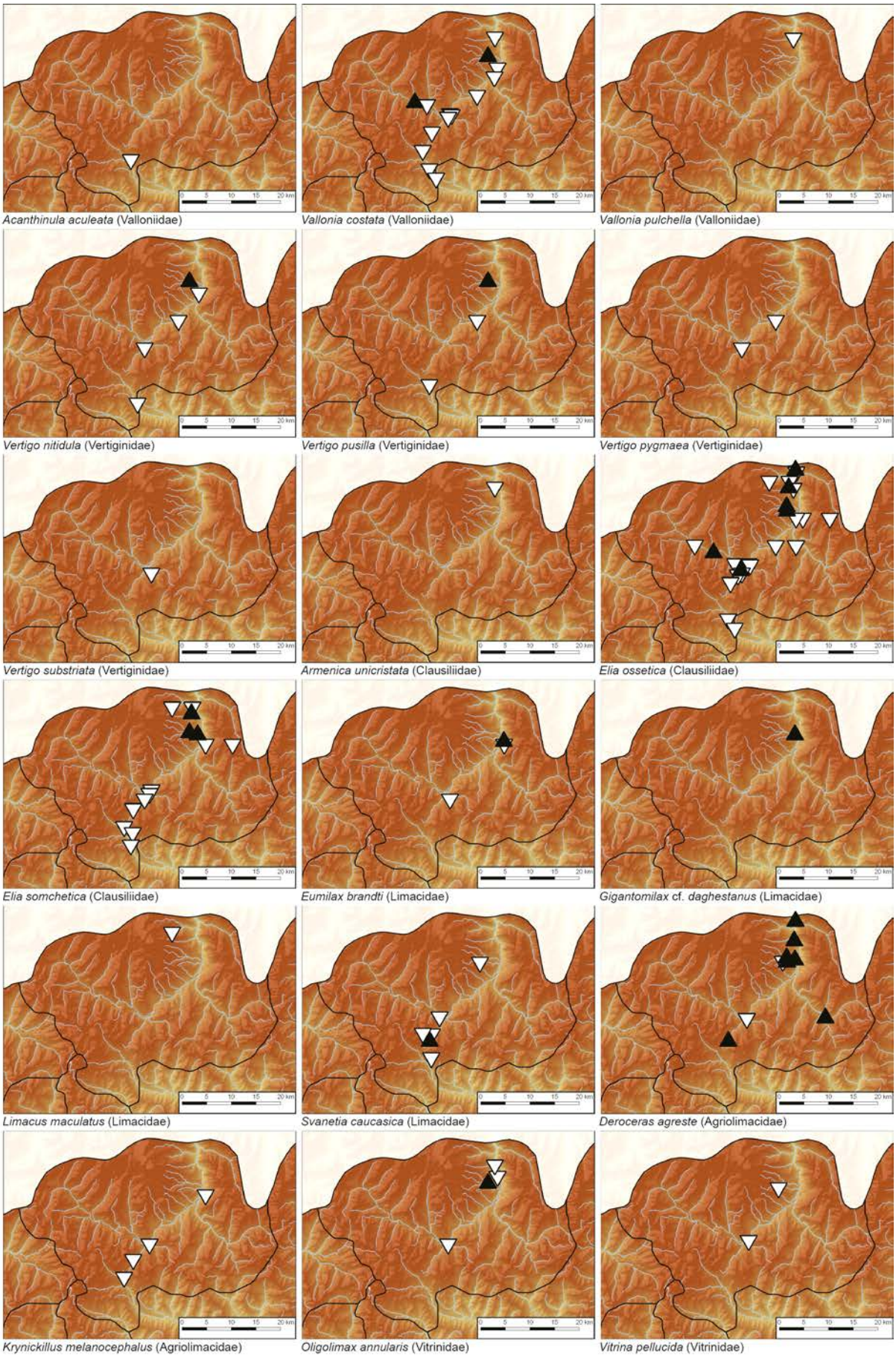

Fig. 6: Distribution of terrestrial gastropods in the Kazbegi Municipality.
Black triangles: records during the BioBlitz 2019, white triangles: previous records.

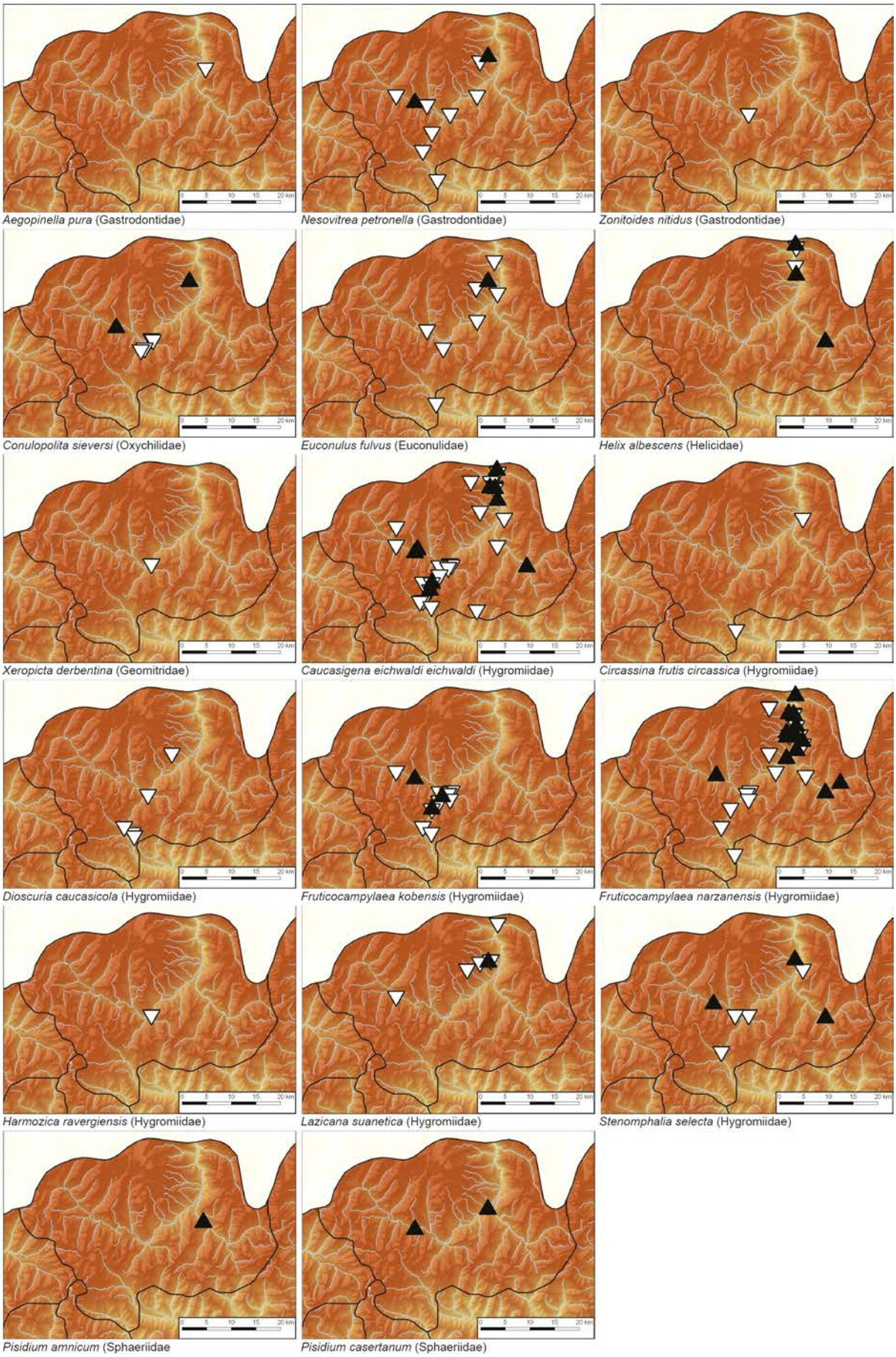

Fig. 7: Distribution of terrestrial gastropods and freshwater bivalves in the Kazbegi Municipality. Black triangles: records during the BioBlitz 2019, white triangles: previous records.

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